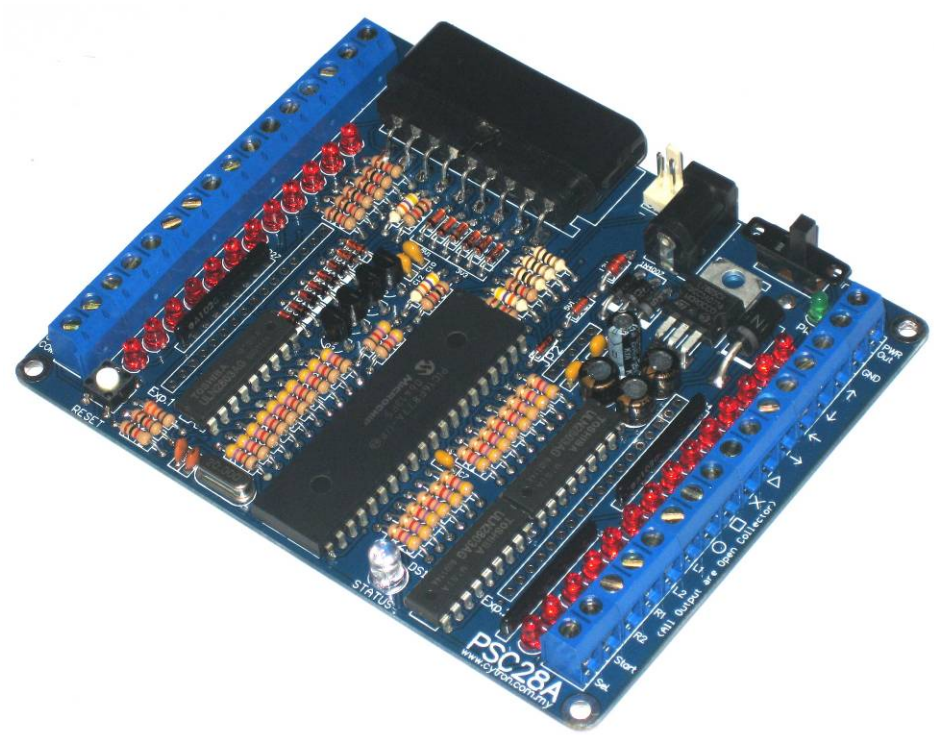
PS2 I/O Converter
PSC28A



User's Manual

V1.0

Jan 2009

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1. INTRODUCTION

As joystick is relatively easy to obtain from any game store and it offers good human machine interface functionality for manual control application. More and more developer and hobbyist are looking into applying existing joystick such as PS2 (Play Station 2) controller to control certain application. The major problems to achieve this are the difficulties to obtain the connector socket for PS2 and the protocol to communicate with it. PS2 connector socket is unique and difficult to source. Besides, most developer found that implementing the PS2 controller protocol to obtain the status (digital and analog) of each button and analog stick are troublesome and time consuming.

With the aim to help solve the problems stated above, Cytron Technologies has design the PSC28A to offer a compact, reliable yet low cost PS2 controller I/O converter for user. PSC28A offers a standard connector socket for PS2 controller (Sony PS2) to plug-in. It also offers fast and simple way to use the joystick as the input of each button will be converted directly into an output on PSC28A.

It has been designed with capabilities and features of:

- 7V-15V power input, current consumption less than 300mA (at 12V supply).
- Using standard PS2 controller connector socket.
- Each button will be represented with an output pin.
- Easy to interface with different voltage system (Open collector output).
- Vibrator motor is controllable.
- Fully compatible with wired or wireless PS2 controller.
- Joy-stick will only operate in analog mode.
- Indicator for each output.
- 4 PWM output to represent the analog.
- **Dimension** 11.7cm x 9.2cm

Note: PSC28A does not come with PS2 controller, please purchase separately from Cytron Technologies website. It is advised to use PS2 controller from Cytron Technologies because all PS2 controller provided is tested before it is being shipped to customer.

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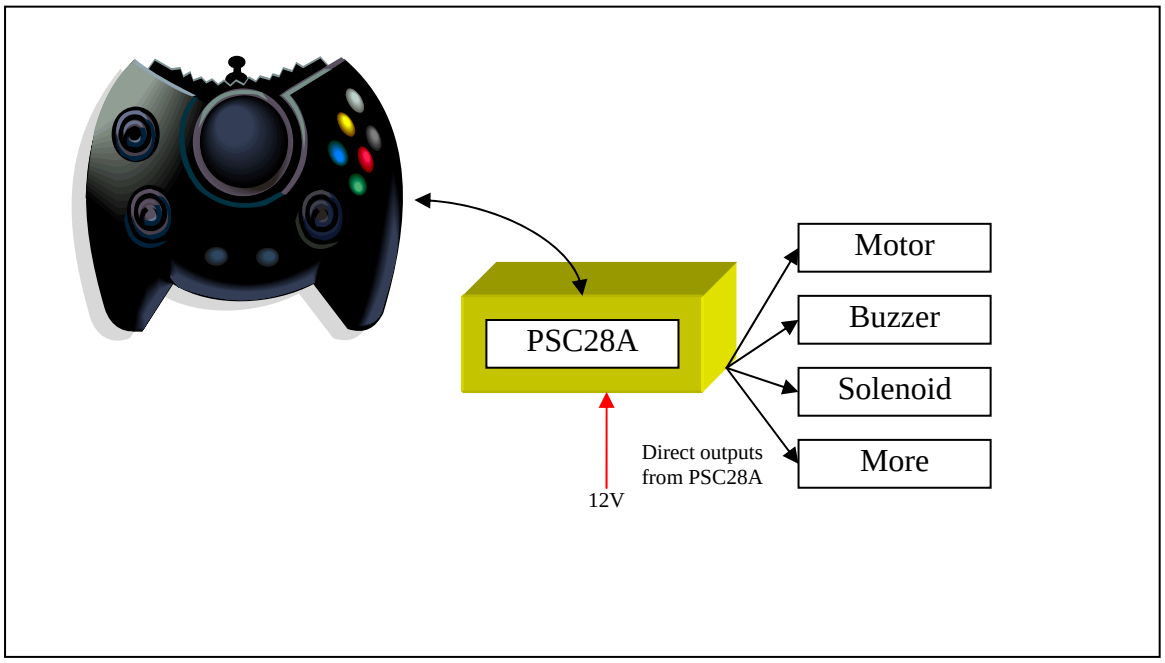
2. SYSTEM OVERVIEW



PSC28A is a PS2 I/O converter which converts the buttons and joystick information on PS2 controller into open collector output. There are 14 open collector output pin for 14 buttons, 4 PWM output for 4 joystick axis, and 8 open collector output for 8 joystick directions. There are also 2 input to control the vibrator motor on the PS controller. PSC28A can be connected directly to motor driver (L293D/L298) to control a motor with controllable speed.

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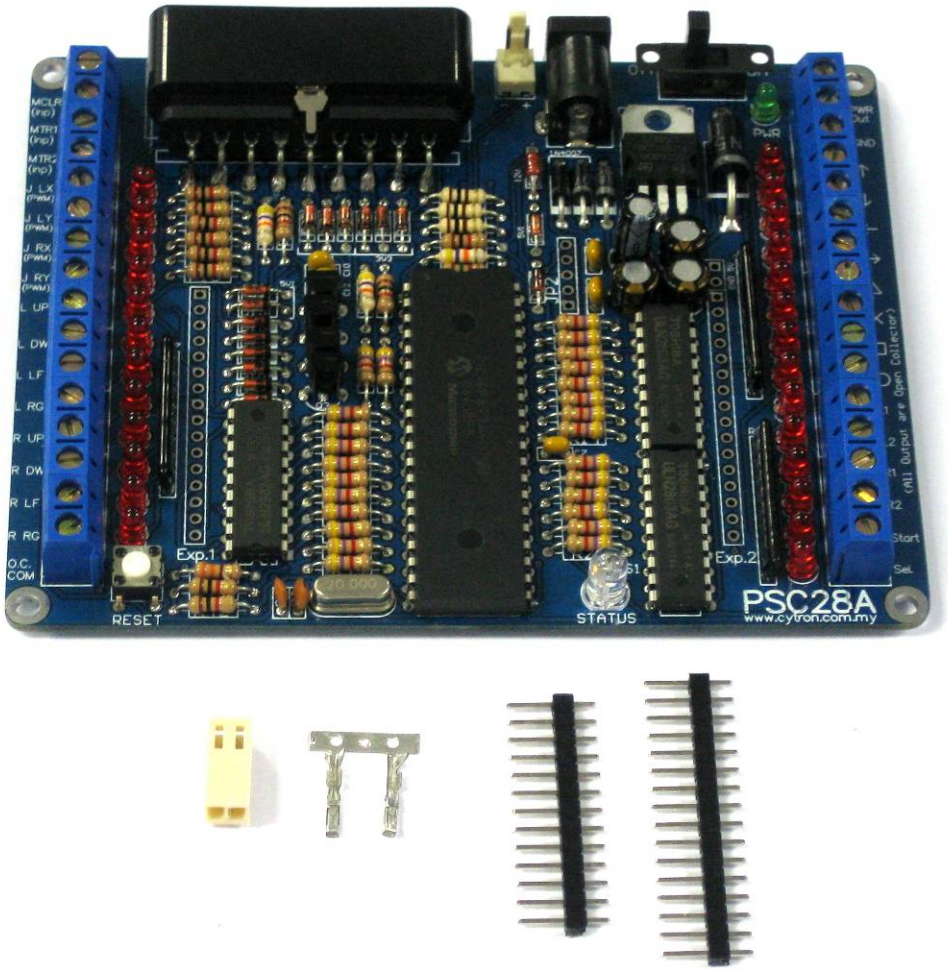
3. PACKING LIST

Please check the parts and components according to the packing list. If there are any parts missing, please contact us at sales@cytron.com.my immediately.



PSC28A come with:

- 1 x PSC28A PS2 I/O Converter board.
- 1 x 2510-02 female connector
- 1 x 16 pin header
- 1 x 18 pin header
- 2 x 2510 iron pin

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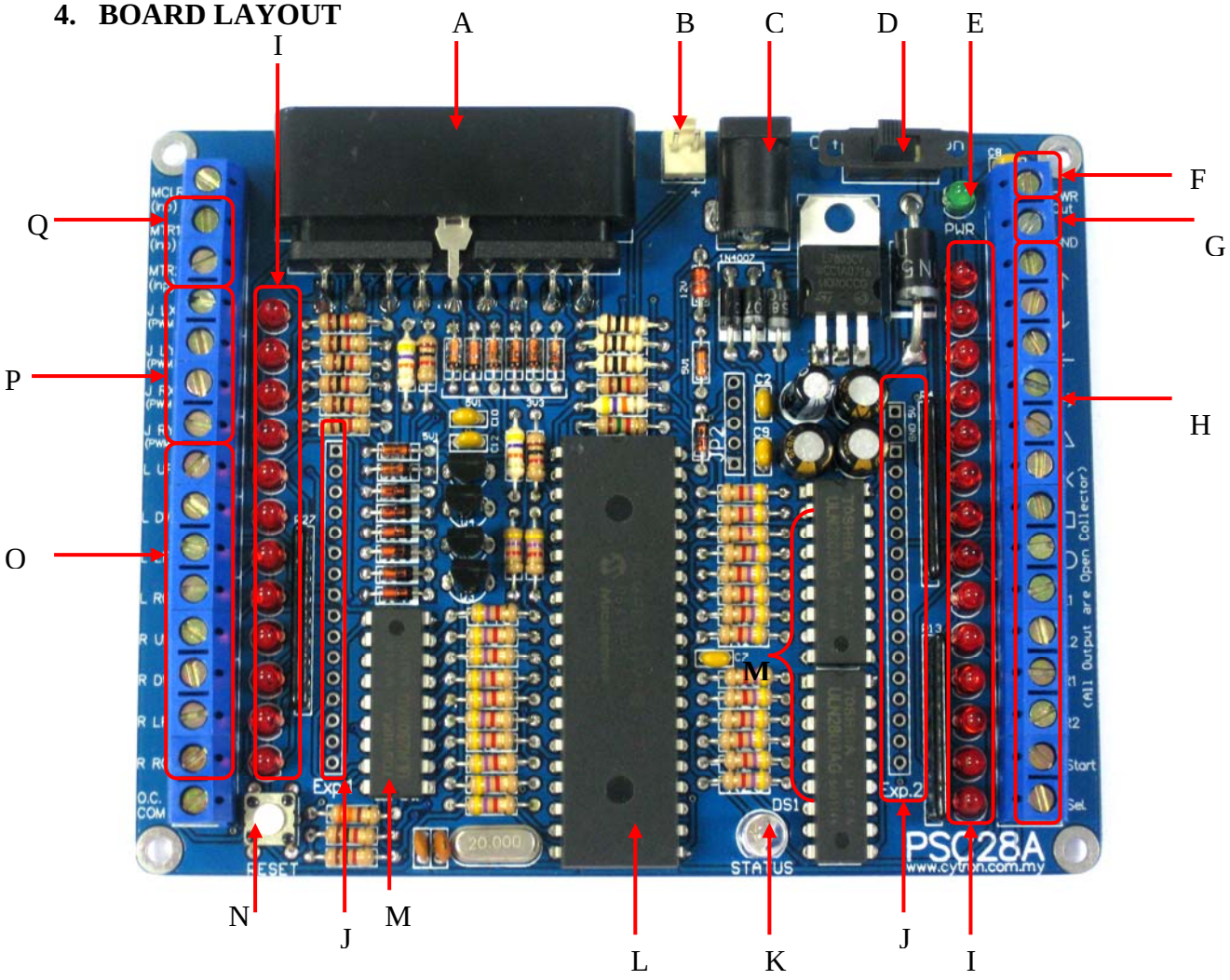
4. BOARD LAYOUT



Label	Function	Label	Function
A	PS2 connector socket	J	Exp.1 and Exp.2
B	Battery connector	K	Status LED
C	DC power adaptor socket	L	PIC microcontroller
D	Slide Switch for main power supply	M	ULN2803AG
E	Power indicator LED	N	Reset button
F	Power out terminal block	O	PSC28A Output terminal (direction)
G	GND terminal block	P	PSC28A PWM output terminal
H	PSC28A Output terminal (buttons)	Q	PSC28A Input terminal
I	Status indicator LED.		

A – PS2 controller connector socket. User may simply connect wired or wireless PS2 controller to this socket.

B – 2510 2 way connector for battery input. The battery voltage should be between 7 to 15V. Please ensure the polarity of voltage is correctly plugged before power up PSC28A. The "+" and "-" have been labeled at the side of connector.

C – DC power adaptor socket for user to plug in DC adaptor. The input voltage should range from 7 to 15V.

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D – Slide switch to On/Off the power supply from DC adaptor or Battery Connector. Sliding the switch to the right will turn on PSC28A.

E – Power indicator LED for on board 5V regulator. It will light up as long as the input power is correctly connected and the slide switch is ON.

F – Power out terminal is terminal to extend power to other board like donut board or bread board. The voltage of Power Out terminal is 0.7V lower than the input voltage. User may simply use mini jumper wire to extend power to donut or bread board.

G – GND terminal for PSC28A board. User may extend this GND terminal onto donut or bread board using mini jumper wire.

H – PSC28A output terminals (buttons) are used to connect to output devices like buzzer, LED, relay and many more. Some example circuit is shown under Hardware Interface section. User may connect this terminal to output device and press corresponding button to activate the output. Each output pin is labeled properly.

I – Status indicator LED indicates the button status. When a button is pressed, corresponding LED will turn on and the output will be pulled low by PSC28A. When the button is released, corresponding LED will turn off and the output will be released.

J – Exp.1 and Exp.2 is area for user to solder header pin to expand PSC28A board to other board like donut board.

K – Communication and button press status LED for the PS2 converter. This LED will blink if PS2 Controller is not detected on the PS2 socket. It can either be the PS2 is not connected properly or the communication between PS2 and PSC28A board failed. If PS2 controller is detected and communication is stable, the LED will illuminate with 50% brightness. It will light up with 100% if any of PS2 controller button is pressed.

L – 40 pin PIC microcontroller.

M – ULN2803A is Darlington transistor array, used to produce open collector output of PSC28A.

N – Reset button for PSC28A

O – PSC28A output terminals (directions) are used to connect output devices like buzzer, LED, relay and many more. Some example circuit is shown under Hardware Interface section. User may simply move the joystick to corresponding direction to activate the output. Each output pin is labeled properly.

P – PSC28A output terminals for PWM output device. User may simply connect PWM output device into this terminal. With PWM, user may control the output for example speed of the motor using corresponding joystick button. The status indicator LED will powered up with brightness corresponding to the percentage of PWM output.

Q – PSC28A input terminals are provided to activate the vibrator inside PS2 controller. User can connect this terminal with input devices to activate the vibrator inside the PS2 controller.

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5. PRODUCT SPECIFICATION AND LIMITATIONS

5.1 Programmer

User does no need to prepare programmer for PSC28A. It is because no programmer is needed for PSC28A.

5.2 Input and Output device

The input devices on PSC28A are as below:

- Reset button
  - A reset button with the function to reset PSC28A

- Slide switch
  - On/Off the power supply from DC adaptor or battery connector.

The output devices on PSC28A are as below:

- 1 status indicator LED : Power LED
  - Green Power LED (PWR) will turn ON when power is supplied to PSC28A.

- 26 status indicator LED:
  - This status indicator LED is for buttons/axis on PS2 controller. There are 14 status indicators LED for 14 PS2 buttons , 4 PWM status indicators LED for 4 joystick axis, and 8 status indicator LED for 8 joystick direction. The LED will turn ON when the buttons/axis on PS2 controller is pressed.

- 1 status indicator LED : Blue LED
  - Status LED (blue) will blink when PS2 controller is not detected, ON with 50% of brightness when PS2 controller is detected, and ON with 100% of brightness when a button is pressed on the PS2 controller.

5.3 Operating voltage

The operating voltage of PSC28A is 12 V. Product specifications and limitations for PSC28A are shown as below.

Absolute Maximum Rating

Parameter	Min	Typical	Max	Unit
Input voltage	7	12	15	V
PWR Out	-	Input Voltage – 0.7	-	V
Current consumption	-	100	300	mA

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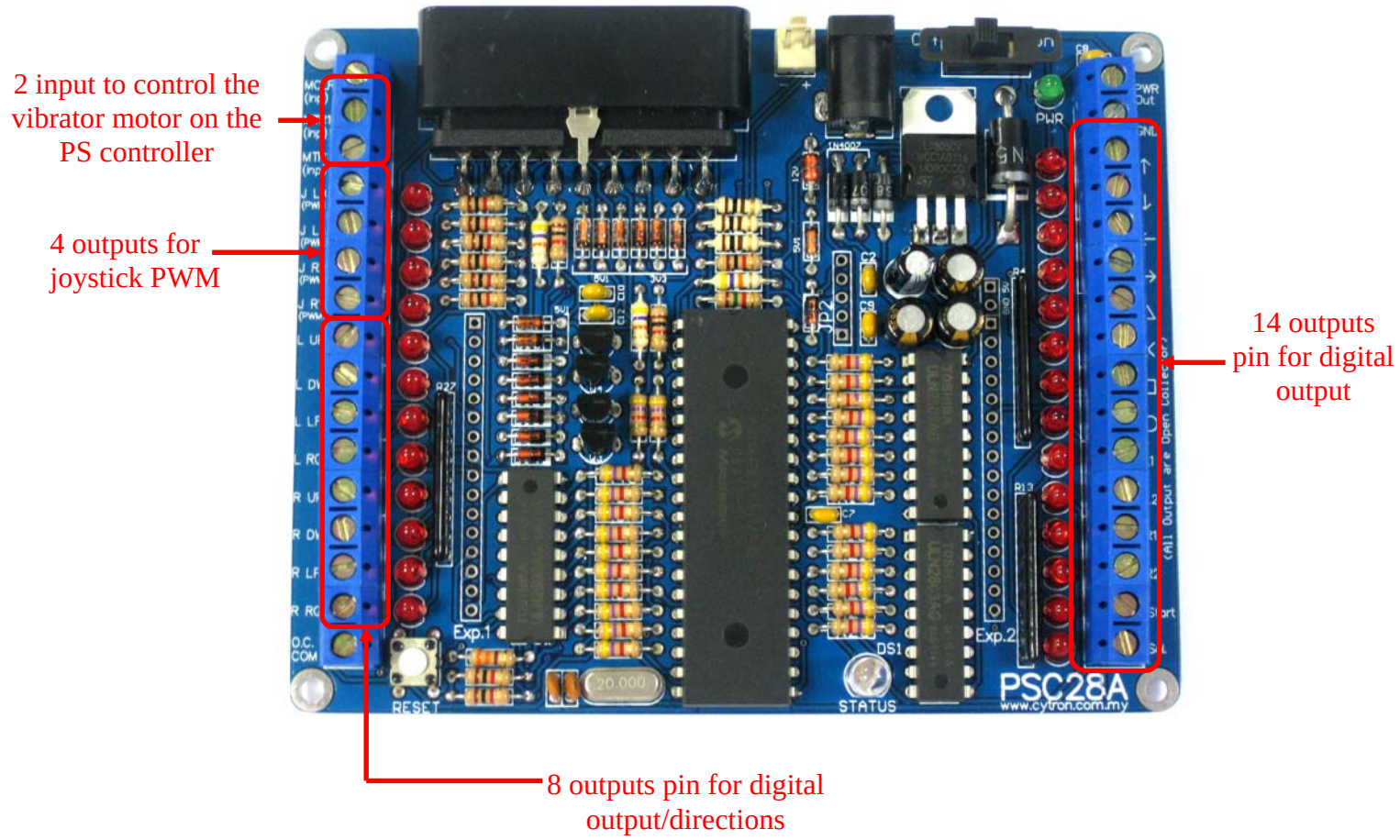
6. HARDWARE INTERFACE

Generally, there are 2 methods of using PSC28A. It has been designed for interface to microcontroller or connects directly into I/O device.

6.1 Input and Output devices

The first method to use PSC28A is connecting with I/O device. There are 14 (5V TTL) digital output pin for 14 PS2 buttons, 4 PWM output for 4 joystick axis, and 8 digital output for 8 joystick direction. There are also 2 input to control the vibrator motor on the PS2 controller. PSC28A may connect directly to motor driver (L293D/L298) to control motor with controllable speed.



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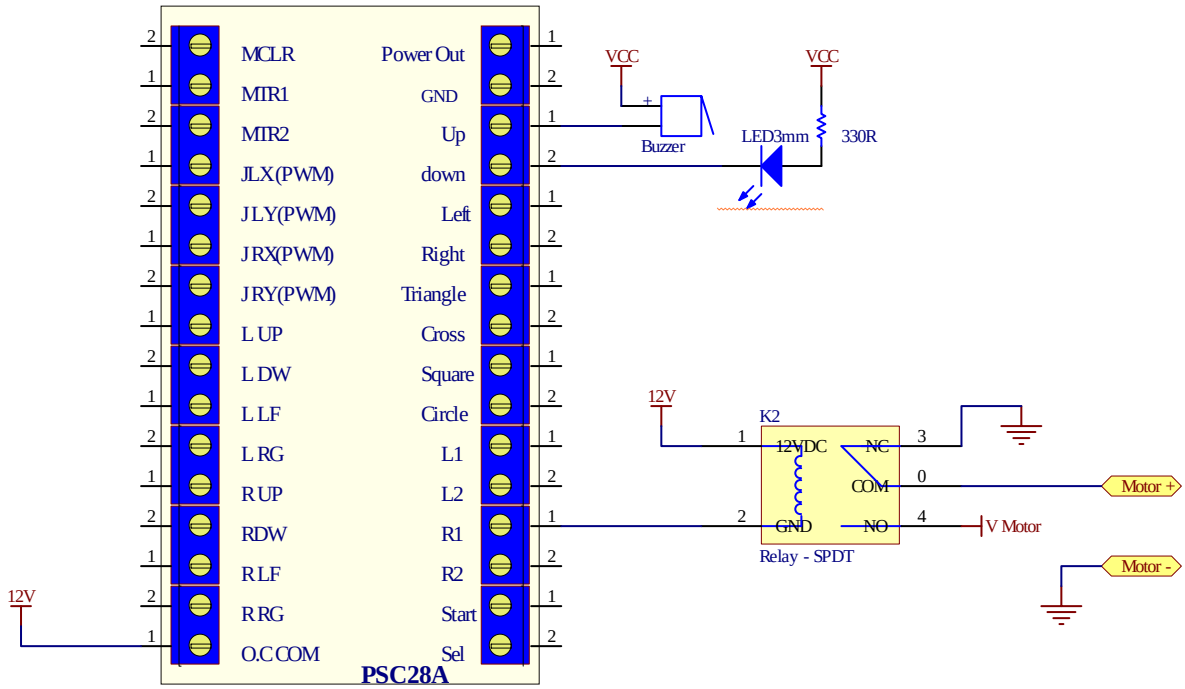
There are 22 digital output terminals on PSC28A which can be activated by buttons and joystick direction. All these digital outputs are active low open collector output. User may connect it with output device like LED, buzzer, relay, motor or many more. Figure below show the example schematic to activate output devices using PSC28A output terminals. Complete list of example circuit can be found under appendixes.



From example schematic above up, button down and R1 are used to activate outputs devices. When user press ↑ (up) button on PS2 controller, buzzer will be activated and corresponding status indicator LED will turn ON. The same for ↓ (down) and R1, LED and motor will be activated when corresponding button is pressed.

4 PWM outputs on PSC28A are J LX, J LY, J RX and J RY. PWM output can be use to control output device like motor with variable speed. PWM output is normally use together with digital output to control motor. PWM output will determine the speed of the motor and the digital output will determine the direction of the motor. The circuitry to connect PWM output and digital output to motor can be found under appendixes.

Normally, PWM output is use together with direction digital output (L UP, L DW, L LF, L RG, R UP, R DW, R LF, and R RG). The PWM output and direction output change simultaneously according to the movement of the joystick. For example, when the left joystick is being move up, the L UP will be activate, while at the same time, the J LY PWM output will increase from 0% to 100%. In the other words, L UP, L DW and J LY is a set of control for a motor where L UP and L DW control the direction and J LY control the speed of the motor. Under this configuration, the motor is fully controlled by the joystick up down movement.

Table below shows the PSC28A Direction and PWM output which can be use to control 4 motor.

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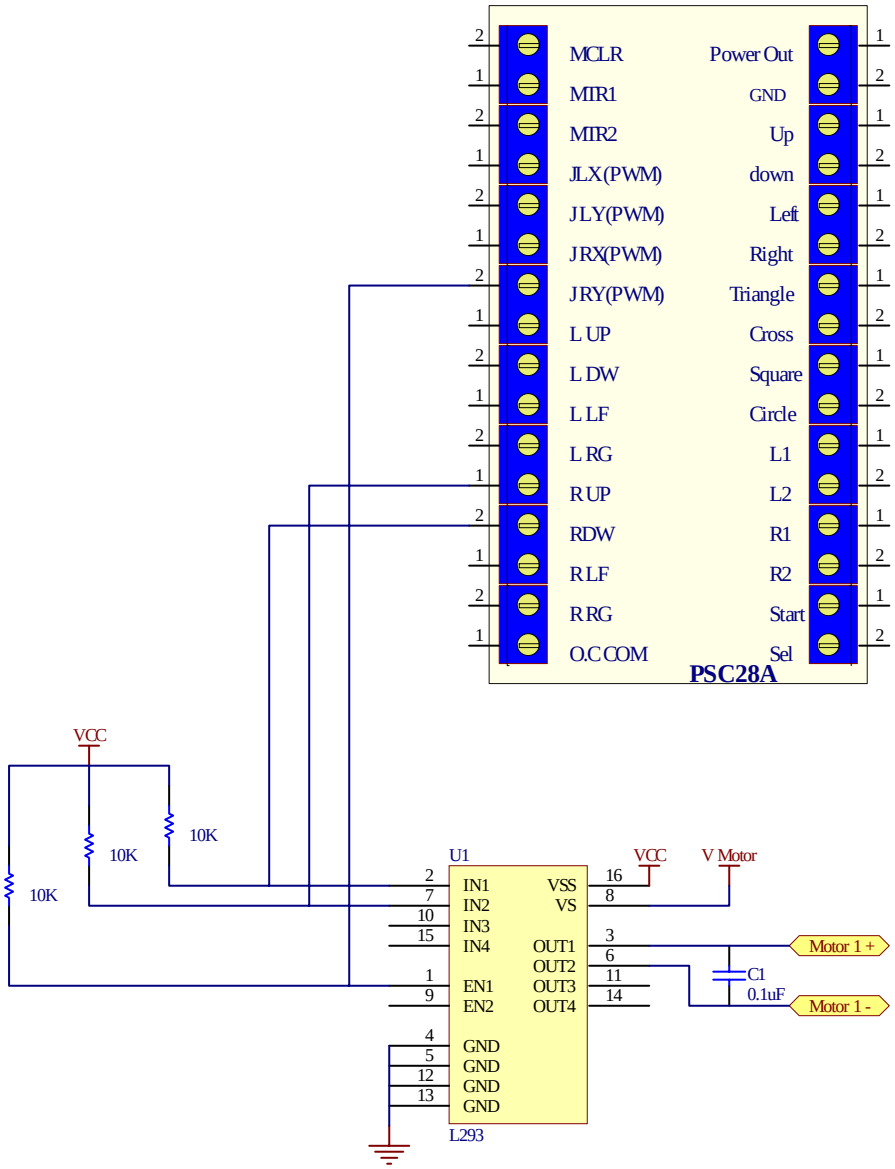
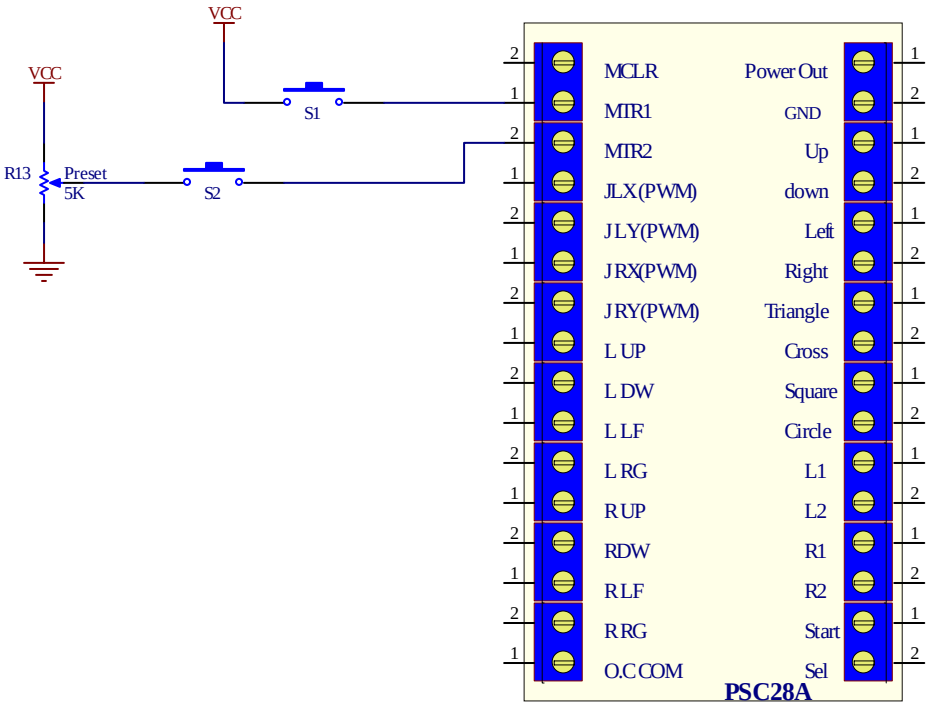
Control set	Motor respond	PSC28A output direction		PSC28A PWM output
Joystick left (up-center-down)	CW-stop-CCW	L UP	L DW	J LY
Joystick left (left-center-right)	CW-stop-CCW	L LF	L RG	J LX
Joystick right (up-center-down)	CW-stop-CCW	R UP	R DW	J RY
Joystick right (left-center-right)	CW-stop-CCW	R LF	R RG	J RX

Figure below show an example to run motor in two direction and PWM is used to control the speed. For this example, PWM pin is connected to J RY (PSC28A PWM output) and input pin is connected to R UP and R DW (PSC28A output direction). When user move right joystick up, motor will run in one direction with speed between 0-100% and when user move joystick down, motor will run in the reverse direction with speed from 0-100%. Corresponding status indicator LED turn ON when joystick buttons move up and down. For more detail about PS2 controller and their speed, user may refer section 6.3.

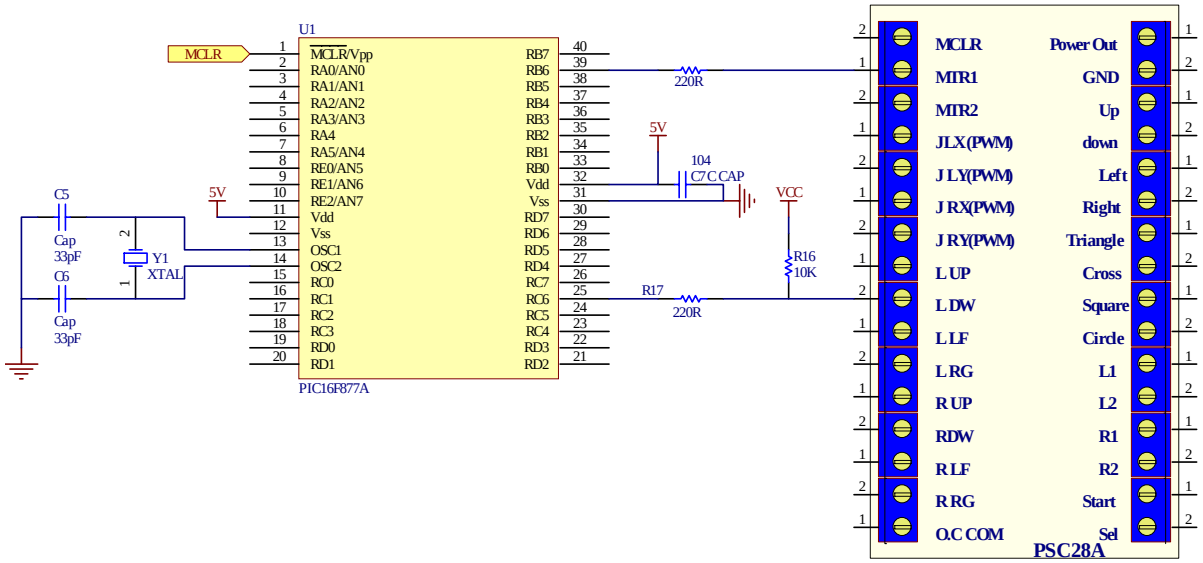


Two PSC28A input terminals are provided to activate vibrator at PS2 controller. User can connect this terminal with input devices to activate the vibrator on PS2 controller. For MTR1 input, the value must be digital 0V or 5V. For MTR2 input, the value can be any voltage from 1V to 5V, where the voltage from 1V to 5V will determine the vibration level from 0% to 100%. Please take note that very low voltage (0V to 1V) will not turn on the vibration motor. Below is example schematic to activate vibrator using input device. From example schematic below, MTR1 is connected to switch and MTR2 is connected to switch and potential meter. MTR1 will activate vibrator 1 when S1 is pressed and MTR2 activate vibrator 2 when S2 is pressed. For vibrator 2, user may control the vibration level using potential meter (preset).



6.2 Microcontroller

Besides interface directly into I/O devices, PSC28A can be use to interface with microcontroller. Below is an example of connection to a PIC16F877A microcontroller.



From the example of connection above, user may connect microcontroller I/O pin to PSC28A's input terminal to activate vibrator motor or PSC28A's output terminal to read the terminal status. To control vibrator motor, output from microcontroller, RB6 is connected to input terminal of PSC28A (MTR1). When the RB6 at microcontroller is set to 1, the vibrator motor will be activated. To read an output terminal status, for example, L DW output terminal is connected to input, RC6 of microcontroller, when the joystick is being move to down position (L DW), microcontroller will read RC6 as low (0). Else, RC6 will be high (1).

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6.3 PS2 Controller

User may choose either wired or wireless PS2 Controller to be connected to PSC28A. Figure below shows how to connect PS2 controller to PSC28A board. They are many type of PS2 controller in the market; the sensitivity and compatibility for each controller are different. User is advised to use PS2 controller from Cytron Technologies. Cytron Technologies does not guarantee the compatibility of other PS2 controller from other source.

(a) Wireless Connection

(b) Wired Connection

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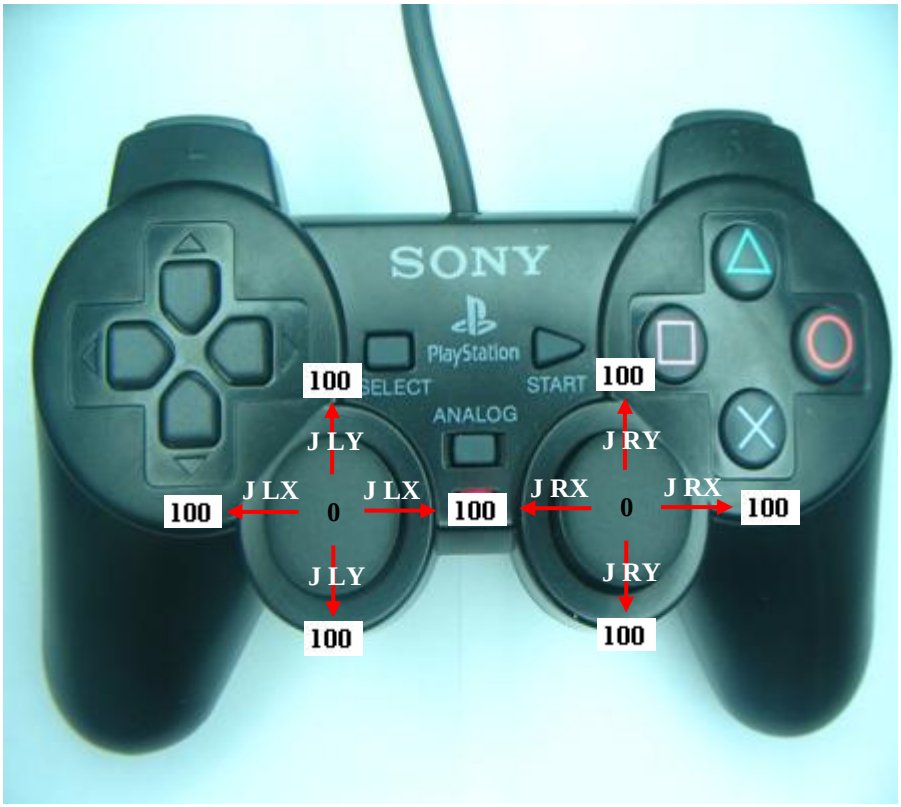
Figure below shows an example of PS2 controller which can be used for PSC28A. There are 14 buttons that can be read by PSC28A. Each button will control an output at PSC28A. The output at PSC28A had been labeled according to the buttons on PSC controller.

For PS2 controller's joystick, each joystick control 4 direction outputs, and 2 PWM output. In direction control, the direction of the joystick will activate direction output on PSC28A. For example, when the left joystick is being move up, the L UP will be activated.

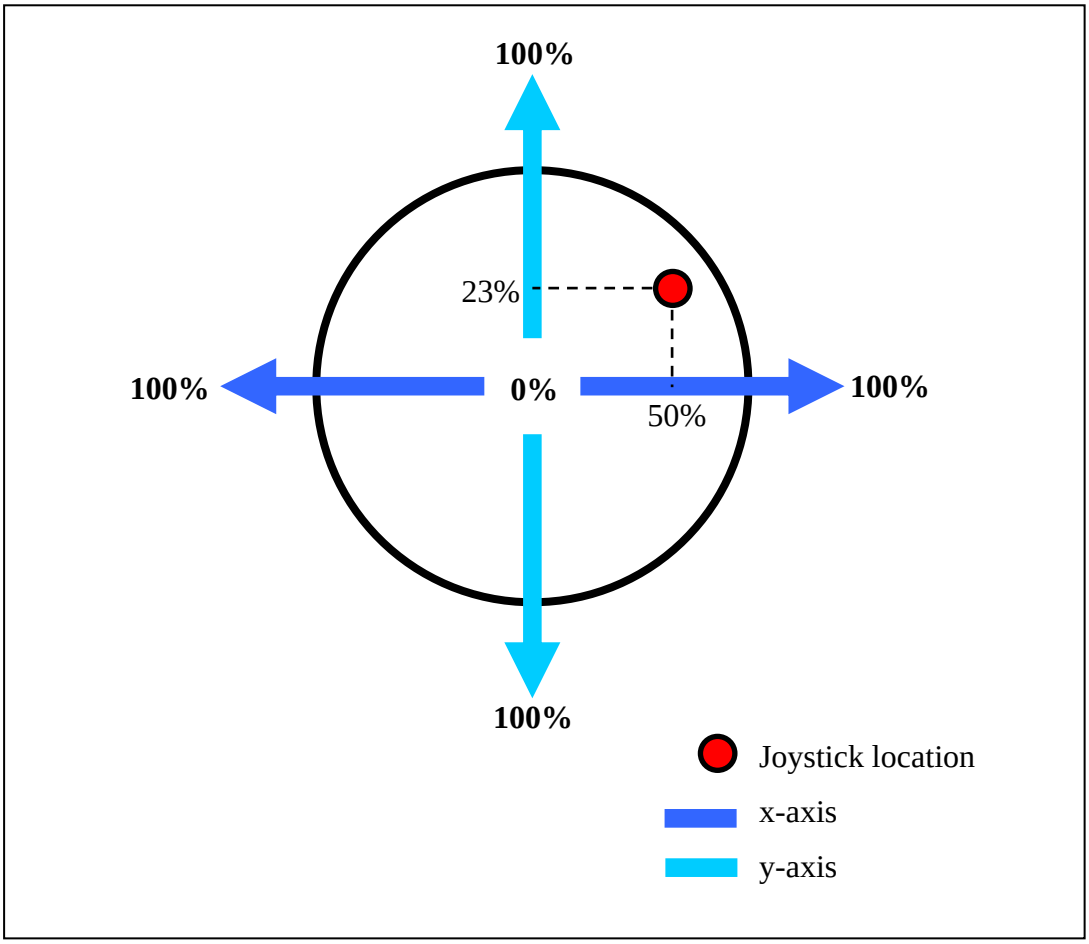
(a) Joystick direction output

For PWM output, each joystick controls 2 PWM output. For example when left joystick is at its origin location, which is at the center, both PWM output (J LX and J LY) will be zero. When left joystick is being move up or down from center, the J LY PWM output will change from 0% to 100%. The value will be 100% at the top most and bottom most. It is the same for left and right, when left joystick is being move left or right from center, the J LY PWM output will change from 0% to 100%. The value will be 100% at the left most and right most. It is similar for right joystick as well.



(b) Joystick PWM output

Let's take an example on left joystick. Referring to the figure below, the left joystick is moved a bit to the right and a bit to the up direction. So, the value of J LX PWM output is 50% and J LY PWM output is 23%.



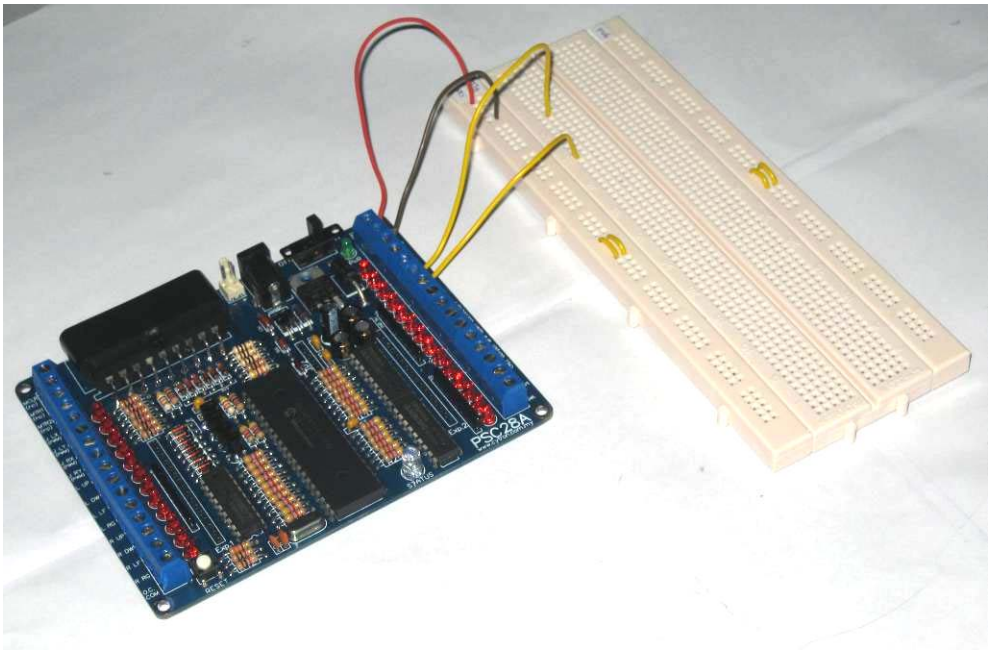
7. GETTING STARTED

This section will show the example on method to operate PSC28A. One of the advantage in using PSC28A is it can operate without the need of developing program. It can be connect directly to output device like motor, buzzer, and LED.

7.1 Connect directly to I/O device (without other microcontroller)

PSC28A is ready to be plug and use, no software is necessary. This PS2 Converter has 28 I/O port which ready be used to start the electronic interface. The I/O can be access through breadboard with expand the I/O terminal using mini jumper wire.

a. Extend the I/O terminal block to breadboard using mini jumper wire.



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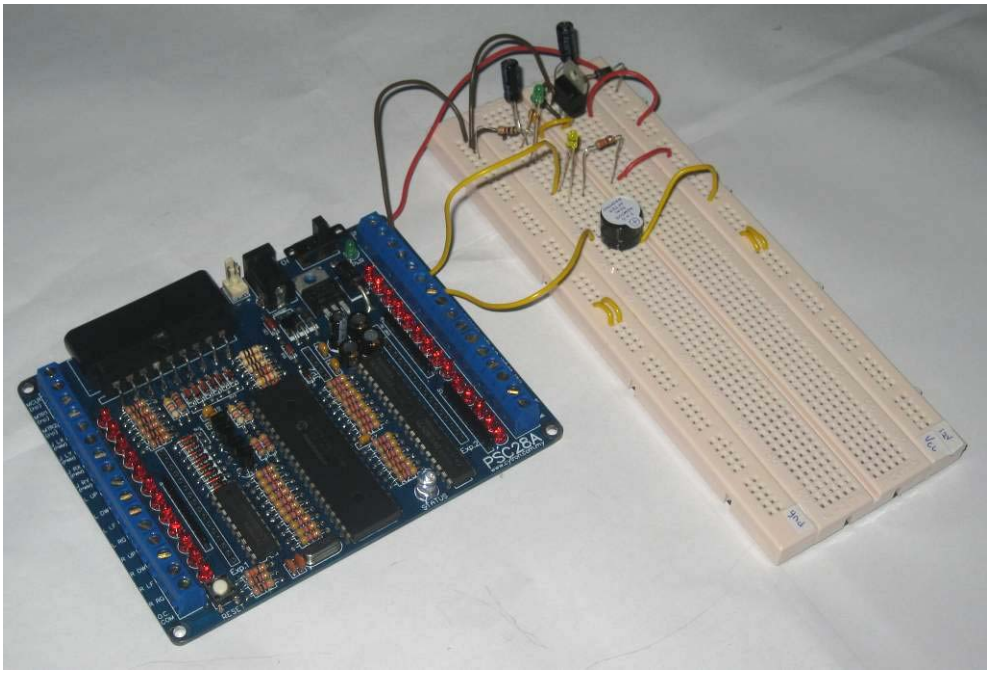
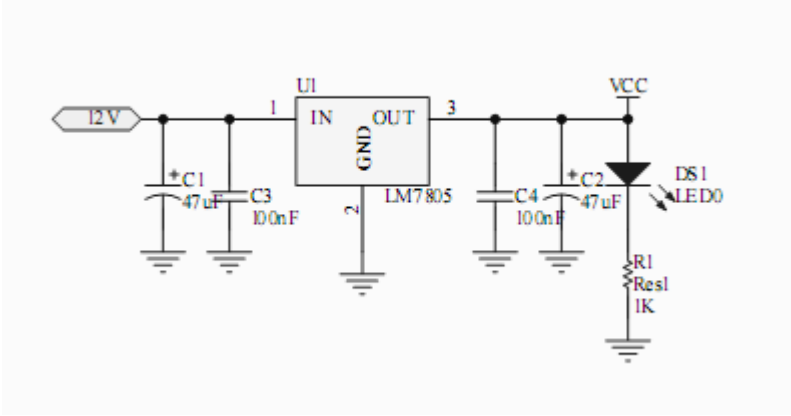
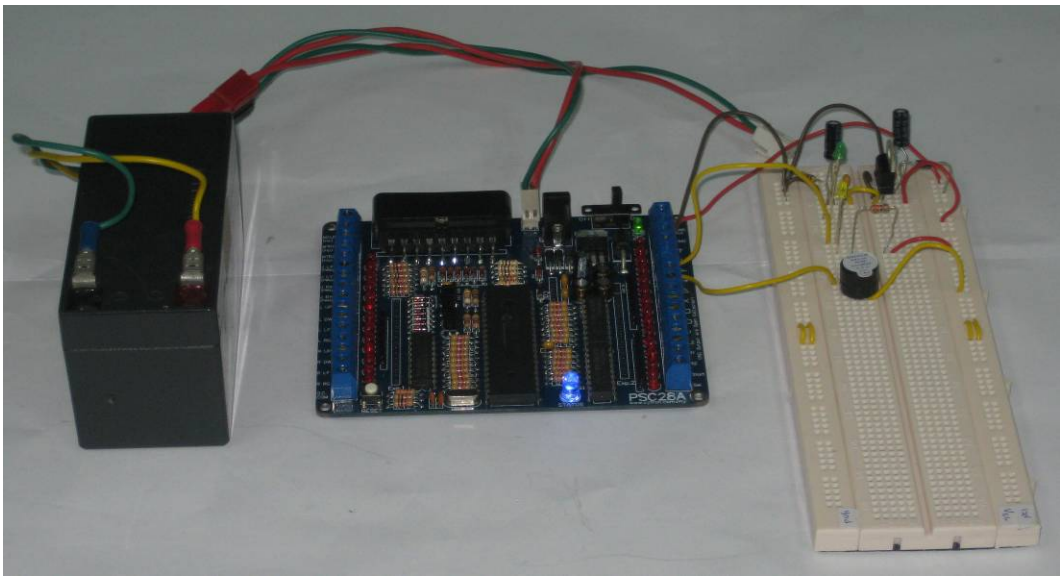
b. Connect the output devices like motor, LED and buzzer according to the provided circuit under appendixes. Picture below show some example circuitry of PSC28A using breadboard.



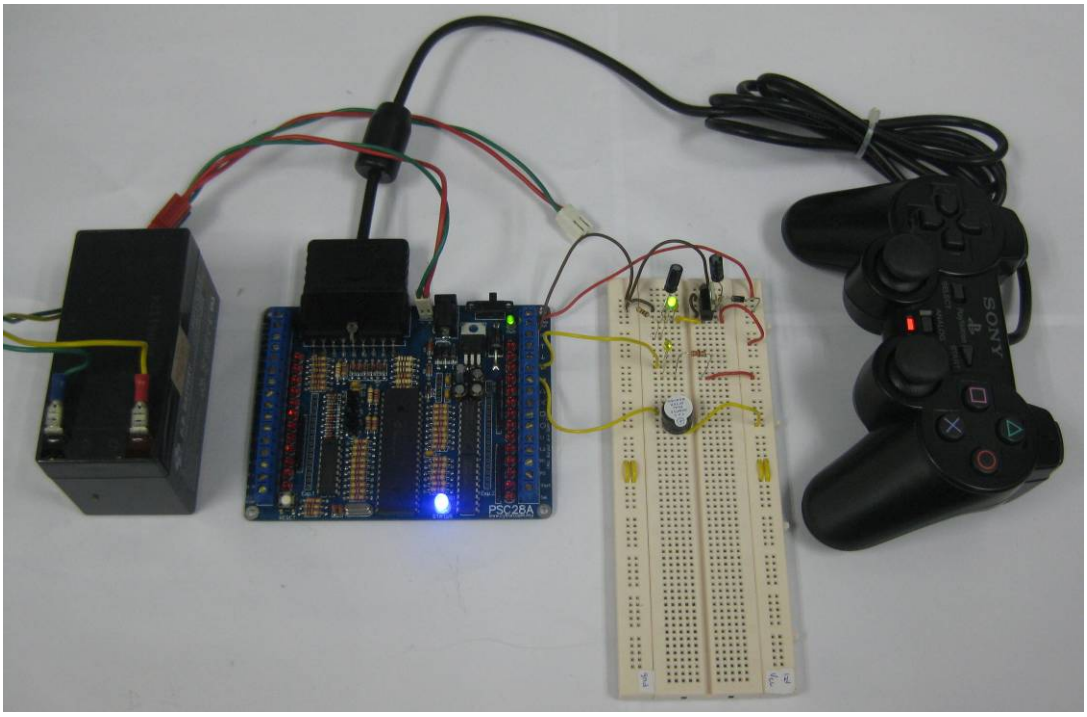
c. Power Out terminal supply 12V from PSC28A board. User need to extend the power out terminal into breadboard using mini jumper. For circuit that needs 5V (Vcc) at breadboard, user need to add voltage regulator to regulate the voltage form 12V to 5V. Figure below show the example of voltage regulator schematic.



d. Connect the battery or power source to PSC28A board as shown below. Please ensure the polarity is correct. PWR LED will turn ON when power applied to the board.



e. Connect the PS2 controller to PSC28A board. If PS2 controller is detected and communication is stable, status LED (blue) will illuminate with 50% brightness.



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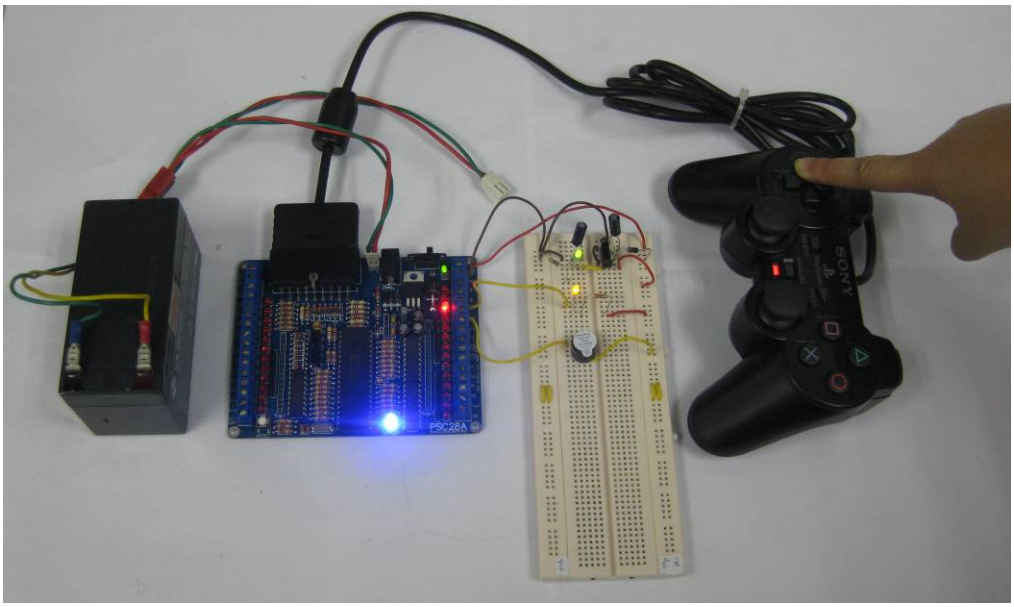
f. Press any button on PS2 controller, the according LED (orange) will light up and status LED (blue) will light up with 100% brightness.



g. User may add more I/O devices like buzzer, brush motor, relay, switch and many more.

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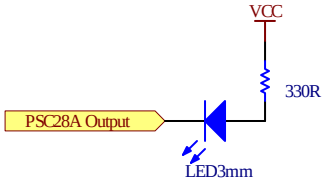
8. APPENDIXES

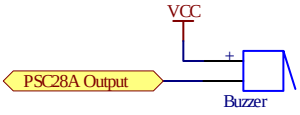
Example circuit for digital output

LED



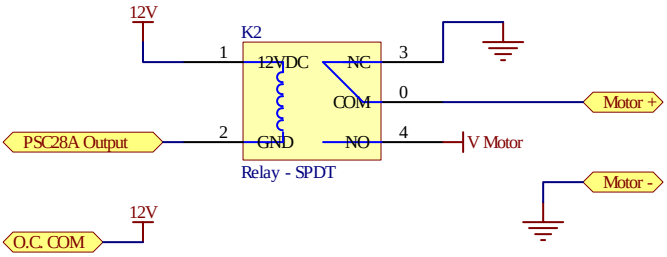
- Corresponding PSC28A Output activate the LED.

Buzzer



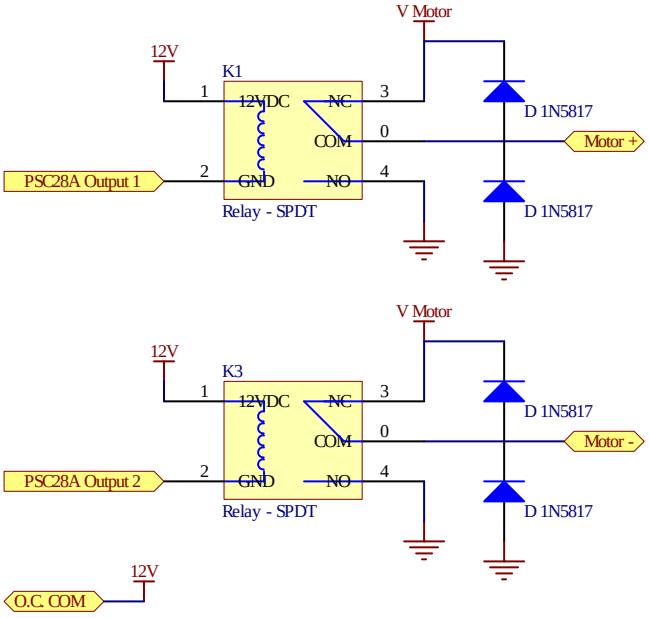
- Corresponding PSC28A Output activate the Buzzer.

One direction Motor



- Corresponding PSC28A Output activate the motor.

Two direction Motor



- PSC28A Output 1 activate the motor in Clockwise, and PSC28A Output 2 activate the motor in Counter Clockwise.

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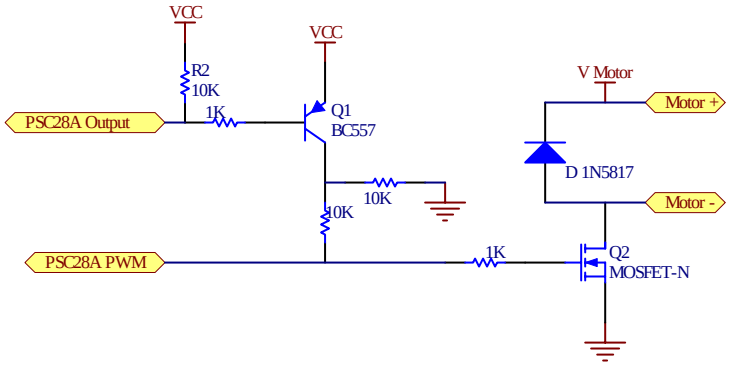
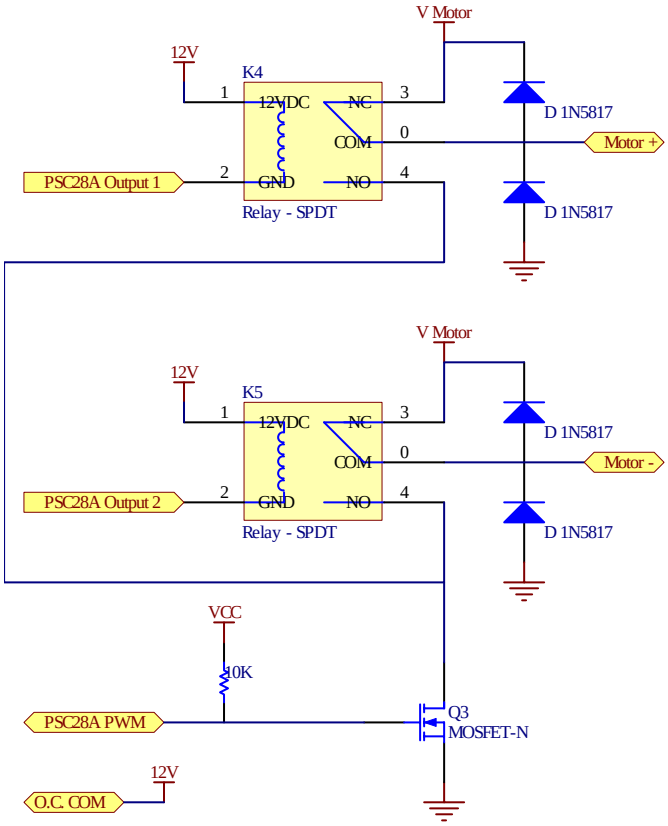
Example circuits for PWM output

One direction Motor (PWM speed control)



- PSC28A Output activate the motor, and PSC28A PWM control the speed of the motor

Two direction Motor (PWM speed control)



- PSC28A Output 1 activate the motor in Clockwise, PSC28A Output 2 activate the motor in Counter Clockwise, and PSC28A PWM control the speed of the motor.

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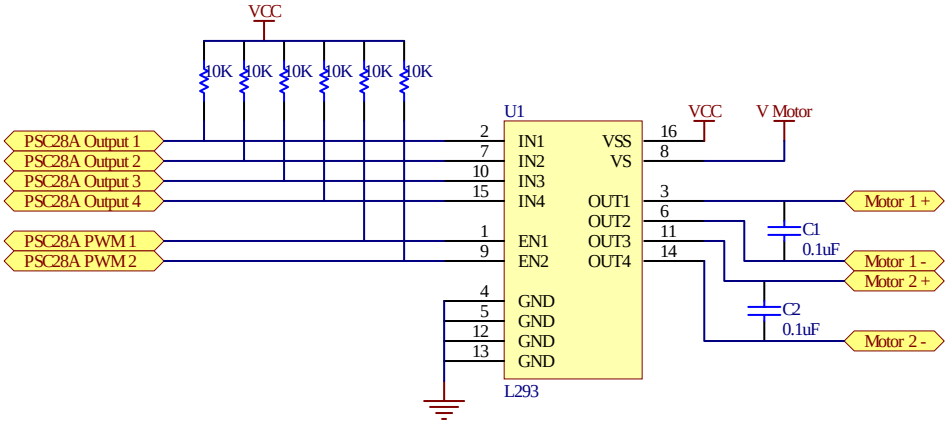
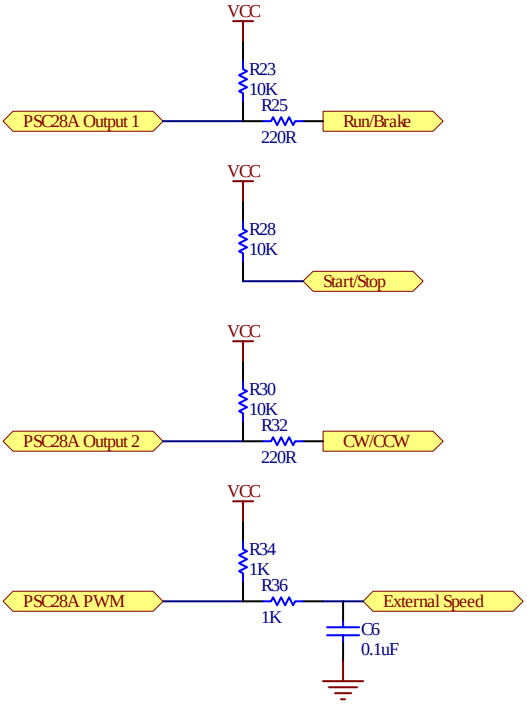
Motor Driver L293D



- PSC28A Output 1 activate the motor 1 in Clockwise, PSC28A Output 2 activate the motor 1 in Counter Clockwise, PSC28A PWM1 control the speed of the motor 1.

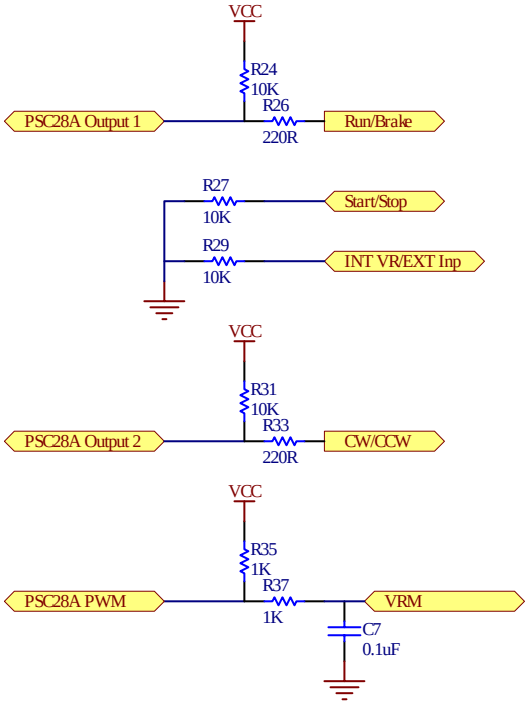
PSC28A Output3 activate the motor 2 in clockwise, PSC28A output4 activate the motor 2 in Counter Clockwise, PSC28A PWM2 control the speed of the motor 2.

PSC28A output control Linix Brushless motor



- PSC28A Output 1 control motor Run/Brake
- PSC28A Output 2 control the motor direction (CW/CCW)
- PSC28A PWM control the motor speed

PSC28A output control Vexta Brushless motor



- PSC28A Output 1 control motor Run/Brake
- PSC28A Output 2 control the motor direction (CW/CCW)
- PSC28A PWM control the motor speed

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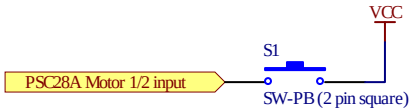
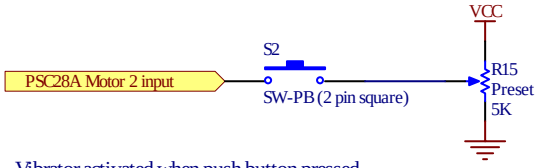
Example circuits for input

Vibrator activated by switch



- Vibrator activated when push button pressed.
- Can be connect to either MIR1 or MIR2.

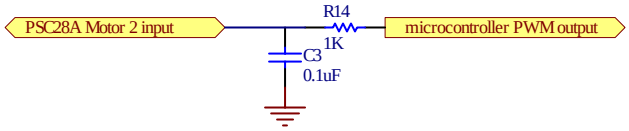
Vibrator activated by switch and potential meter



- Vibrator activated when push button pressed.
- Can be connect only to MIR2.
- Vibration can be adjust using potential meter R13.

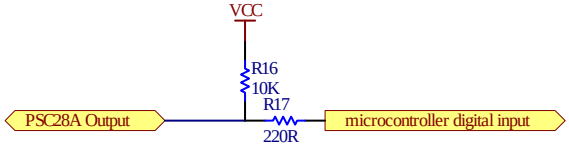
Example circuits for PSC28A to microcontroller

Microcontroller PWM control vibrator



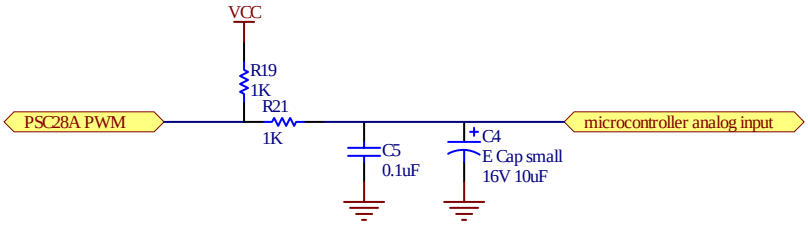
- Vibrator activated with corresponding PWM value
- Can be connect only to MIR2.

PSC28A output to microcontroller



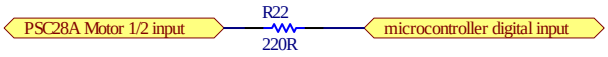
- Microcontroller read '0' when the PSC28A activated.

PSC28A PWM output to microcontroller



- Microcontroller read 0V-5V when PSC28A PWM change.

Microcontroller control vibrator



- Vibrator activated microcontroller output '1'.
- Can be connect to either MIR1 or MIR2.

9. WARRANTY

- Product warranty is valid for 6 months.
- Warranty only applies to manufacturing defect.
- Damage caused by miss-use is not covered under warranty.
- Warranty does not cover freight cost for both ways.

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